ASSOCIATION OF GENDER AND BONE DENSITY - A RETROSPECTIVE STUDY

Hemashree J[1], Dr. Revathi Duraisamy[2], Dr. Manjari Chaudhary[3]

Abstract

BACKGROUND: *Long-term survival of the implant is expected for the evaluation of success rate. In spite of the high success and survival rates , failures do arise and the certain factors are responsible for this. They include health age, gender, status habits, quality of bone, oral hygiene maintenance etc. Since , all the above can be involved, bone density influences the survival of implants to a greater extent.*

AIM: *The aim of this study is to assess the association between gender and bone density in implant received patients.*

MATERIALS AND METHODS: *This retrospective study included patients who had reported to saveetha dental college during June 2019- March 2020. Case records of 86, 000 patients were reviewed and 400 subjects were recruited for the studybased on the inclusion criteria such as age , gender, bone density and implant treatment received. Data was entered in excel sheet and later exported to SPSS software for statistical analysis. Both descriptive (percentage)and inferential statistics(Chi square test) were done.*

RESULTS: *D2 was the most common type of bone density noticed among implant patients(64.8%).No statistical significance for association of bone density and site of implant placement.(p>0.05) . Statistical significance were observed between bone density and gender(p<0.05).*

CONCLUSION: *Thus to conclude bone density was higher for the younger age group. There was an association between gender and bone density.*

KEY WORDS: *age, association, bone density, gender, implant survival.*

I. Introduction

The term "Dental Implants' is now gaining a wide range of popularity in dentistry. Dental implant treatment had a routine clinical application in dental practice for several decades[1,2] and is an important component of prosthodontic procedures that improve the satisfaction and quality of a patient's life[3,4].

Long-term survival of the implant is expected for the evaluation of success rate. In spite of the high success and survival rates , failures do arise and the certain factors are responsible for this. They include health age, gender, status habits, quality of bone, oral hygiene maintenance etc. Since , all the above can be involved, bone density influences the survival of implants to a greater extent[5,6].

[1] Saveetha Dental College and Hospitals, Saveetha Institute of Medical and technical sciences(SIMATS), Saveetha University, Chennai, India, 151501063.sdc@saveetha.com
[2] Corresponding author, Senior lecturer, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and technical sciences (SIMATS), Saveetha university, Chennai, India, revathid.sdc@saveetha.com
[3] Senior lecturer, Department of Oral Medicine and Radiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and technical sciences (SIMATS), Saveetha University, Chennai, India, manjaric.sdc@saveetha.com

Bone density of implants according to Misch is classified as follows:

D1 : > 1250 HU - Anterior Mandible

D2 : 850-1250 HU - Anterior and posterior Mandible.

D3 : 350 - 850 HU- Anterior and posterior Maxilla

D4 :150 - 350 HU - Posterior Maxilla

D5 : <150 Hu: Immature.

Among these D5 is not preferred usually for implant placement In the jaws, an implant placed in poor-quality bone with thin cortex and low-density trabeculae has a higher chance of failure compared with the other types of bones. This low density bone is often found in the posterior maxilla and several studies report higher implant failure rates in this region . When compared to the maxilla, clinical reports have indicated a higher survival rate for dental implants in the mandible, particularly in the anterior region of the mandible, which has been associated with better volume and density of the bone.

As the patient age increases there can be certain factors that can lead to reduction in bone density. For eg. in the female population osteoporosis is much common which can lead to failure of implants[7]. However, there are contradicting responses to this.According to a study [8] bone density is higher for mandibles than for the maxilla ; ie, higher for the posterior .Several factors, such as implant geometry, preparation technique, and quality and quantity of local bone influence primary stability, and primary implant stability is one of the main factors influencing implant survival rates. It is a prerequisite to establish mechanical rest, which seems to be essential for undisturbed healing and osseointegration. Implant stability can be measured by non-invasive clinical test methods (i.e., insertion torque, the periotest, resonance frequency analysis). One of these quantitative methods is the insertion torque described by Johansson and Strid. This method records the torque required to place the implant and provides valuable information about local bone quality.

Previously our team had conducted numerous clinical trials [9–13] and systematic reviews [14–18] and surveys [19,20] over the past 5 years. Now we are focussing on Retrospective study. The idea for this study stemmed from the current interest in our community.

Thus, this study aims at assessing the bone density and correlating it with gender and a to find out any possible association between them.

II. MATERIALS AND METHODS :

STUDY DESIGN AND STUDY SETTING:

This retrospective study included 400 subjects who reported to saveetha Dental College during June 2019 - March 2020 for dental treatment. Online database was used for data retrieval. Ethical approval was obtained from the institutional ethical committee .

DATA COLLECTION:

Data of 86,000 patients were analysed and 5000 patients who reported to the department of Implantology,Saveetha Dental College between June 2019-March 2020 were reviewed and 400 patients who met the inclusion criteria set for the study such as age, gender, site of implant placed , bone density were included in the study. Both males and females of the age group 21-70 years were taken into account.Patients with any systemic illness were excluded from the study. Repeated and incomplete data records were excluded. Data verification was done by an external reviewer.

STATISTICAL ANALYSIS:

Data was entered in microsoft excel sheet and later exported to spss software (version 20.0) for statistical analysis · Variable definition process was done. Both descriptive (frequency) and inferential (chi square test) were employed. Level of significance was set at $p<0.05$ for this study.

III. RESULTS :

DESCRIPTIVE STATISTICS:

Figure 1 and table 1 shows that the highest no. of implant receiving patients belonged to the age group 21-30 years whereas it was least in the age group of 61-70 years. It was also inferred that as age increases the implant treatment also decreases in number. Figure 2 and table 2 shows that males had received the highest number of dental implants. Figure 3 and table 3 indicates that D2 was the most common type of bone density noticed among the patients.

Age	Frequency	Percent
21-30	124	31
31-40	96	24
41-50	96	24
51-60	62	15.5
61-70	22	5.5
Total	400	100

Table 1: Frequency and percentage distribution of implant treatment according to age. It is noted that the highest no. of implant receiving patients belonged to the age group 21-30 years (31%) whereas it was least in the age group of 61-70 years(5.5%).

GENDER	Frequency	Percent
FEMALE	161	40.3
MALE	239	59.8
Total	400	100

Table 2: Frequency and percentage distribution of implant treatment according to gender.

Males(59.8%) had received the highest number of dental implants compared to females(40.3%)

BONE DENSITY	Frequency	Percent
D1	57	14.2
D2	259	64.8

D3	81	20.3
D4	3	0.8
Total	400	100

Table 3: Frequency and percentage distribution of implant treatment according to bone density. D2(64.8%) is the most common type of bone density followed by D3 (20.3%) among implant patients.
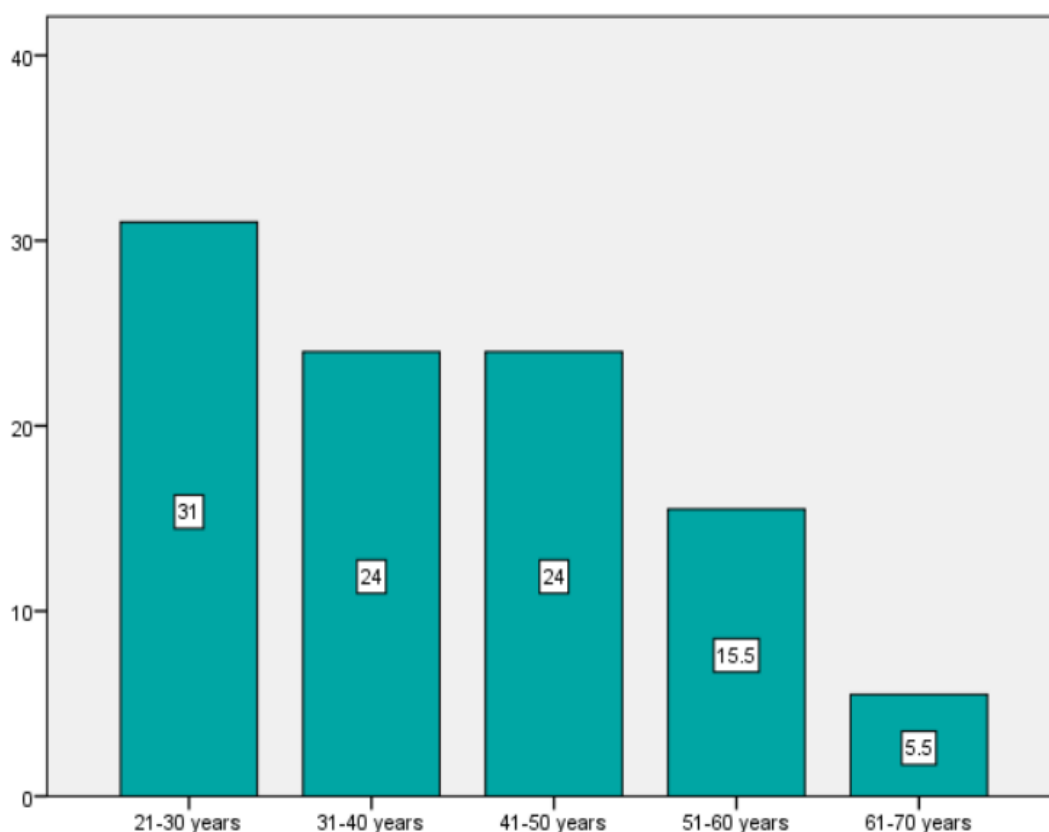

Figure 1: Bar graph depicting the distribution of implant treatment according to age. X- axis shows the age of the patient and Y- axis shows the percentage of implants received. It was noted that the highest no. of implant receiving patients belonged to the age group 21-30 years (31%) followed by 31-40 years of age (24%) ,41- 50 years of age (24%), 51-60 years of age (15.5%). It was least in the age group of 61-70 years(5.5%).
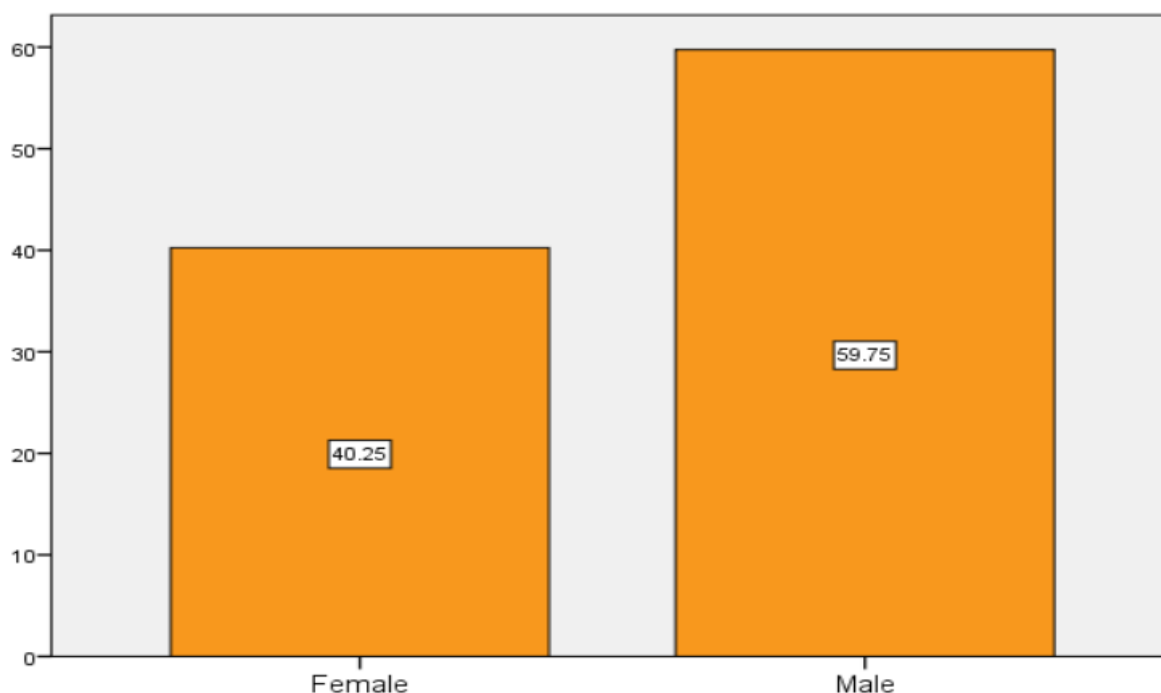
Figure 2: Bar graph depicting the distribution of implant treatment according to gender. X- axis shows the gender of the patient and Y- axis shows the percentage of implants received. It was noted that the males(59.8%) had received the highest number of dental implants compared to females (40.3%).
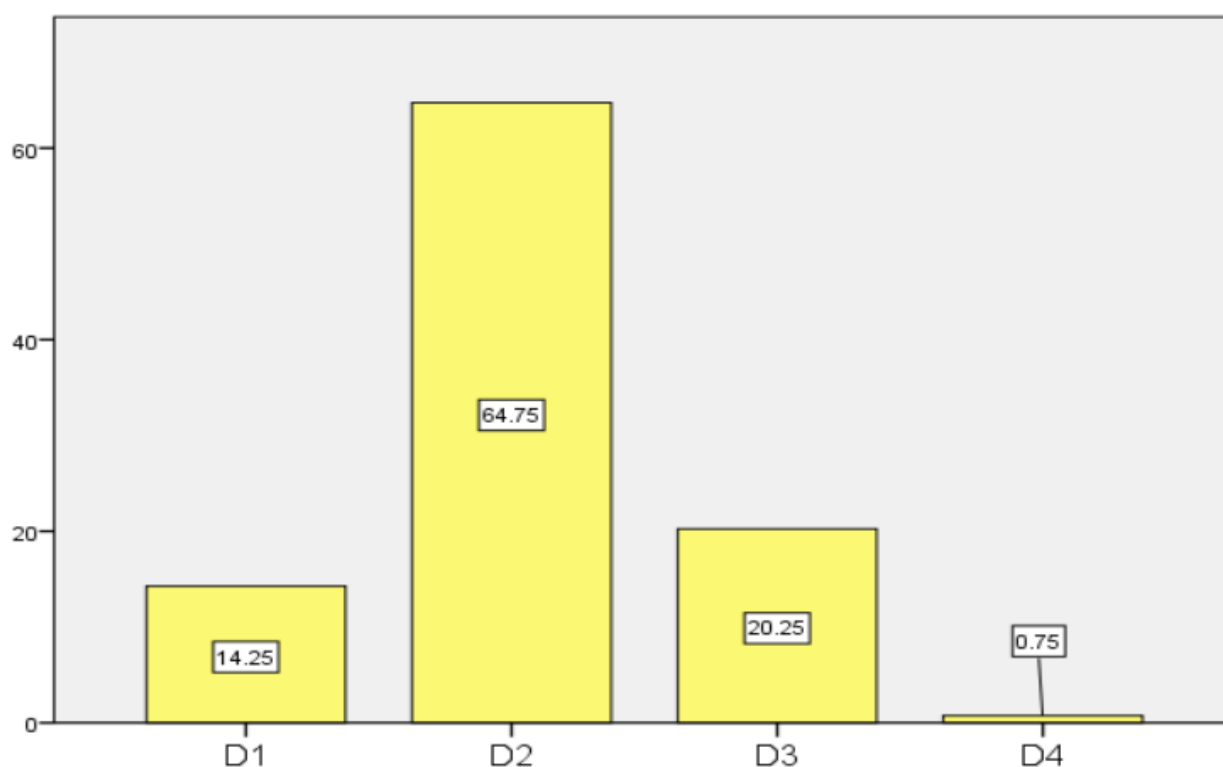

Figure 3 : Bar graph depicting the distribution of implant treatment according to bone density. X- axis shows the type of bone density of the patient and Y- axis shows the percentage of implants received according to bone density . D2(64.8%) was the most common type of bone density followed by D3 (20.3%), D1(14.25%), D4(0.75%) among implant patients.
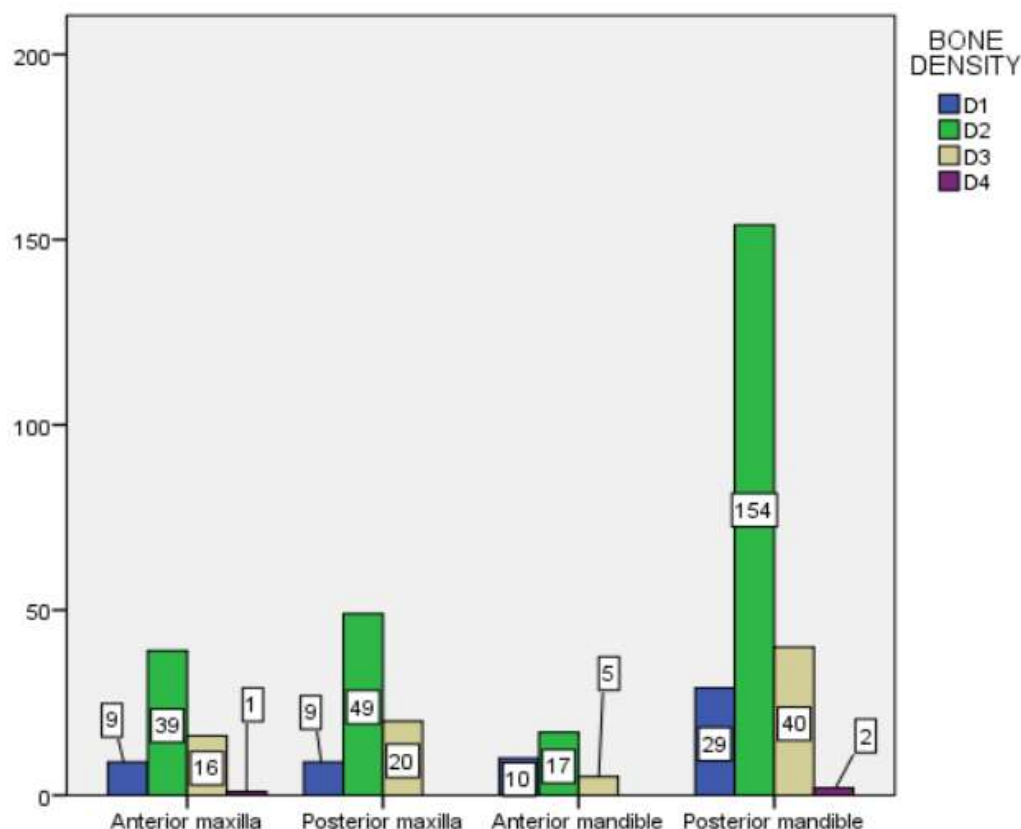
FIGURE 4 : Bar graph depicting the association between sextant and type of bone density. X-axis indicates the site of implant placement and Y - axis indicates the type of bone density.Dark blue colour denotes D1 type(Anterior maxilla:9; Posterior maxilla:9; Anterior mandible:10; Posterior Mandible:20) green colour denotes the D2 type(Anterior maxilla:39; Posterior maxilla:49; Anterior mandible:17; Posterior Mandible:154), brown colour denotes the D3 type(Anterior maxilla:16; Posterior maxilla:20; Anterior mandible:5; Posterior Mandible:40) and purple colour denotes the D4 type(Anterior maxilla:1;Posterior Mandible:2). Chi square test was done and the association between site of implant placement and type of bone density was found to be statistically not significant.(Chi square test-12.77, p=0.17, p>0.05). Though it was not statistically significant it is seen that D2 (n=154) was the most common type of bone density present in the mandibular posterior region and D4 (n=2) was the least common type in the mandibular posterior region.
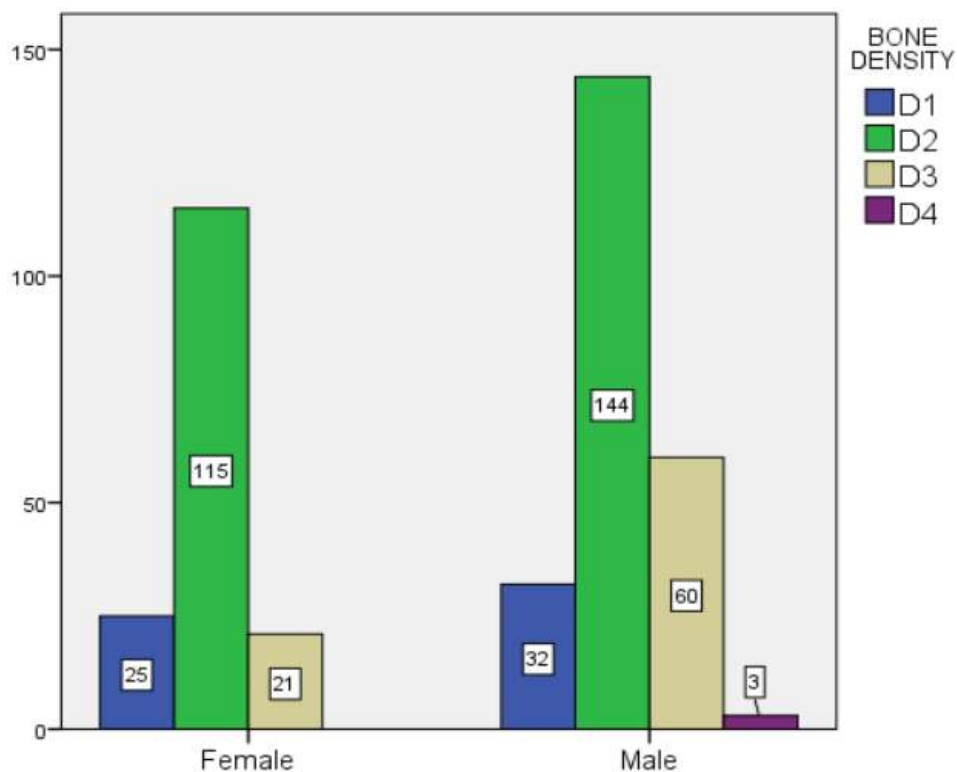
FIGURE 5 : Bar graph depicting the association between gender and type of bone density. X-axis indicates the gender of the patient and Y - axis indicates the types of bone density.Dark blue colour denotes D1 type (female-25, male-32) , green colour denotes the D2 type (female-115, male-144), brown colour denotes the D3 type (female-21, male-60) and purple colour denotes the D4 type(male-3).Chi square test was done and the association between gender and type of bone density was found to be statistically significant.(Chi square test-11.67, p=0.01, p<0.05). So it was noted that among the males, D2 (n=144) is the most common type of bone density and D4 (n=3) is the least common type.Among the females, D2 (n=115) was the most common type of bone density and D3 (n=21) was the least common type.
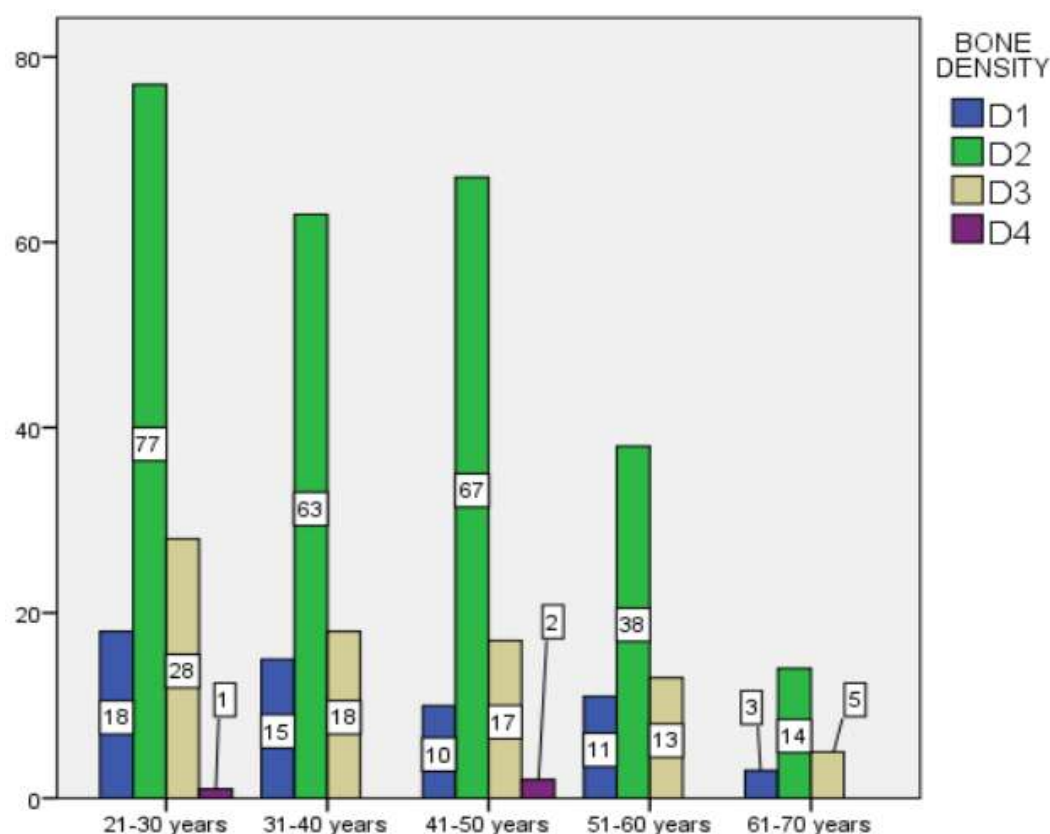
Figure 6 : Bar graph depicting the association between age and type of bone density. X-axis indicates the age of the patient and Y - axis indicates the types of bone density.Dark blue colour denotes D1 type (21-30 years of age -18, 31-40 years of age - 15, 41-50 years of age-10, 51-60 years of age-11, 61-70 years of age-3) , green colour denotes the D2 type (21-30 years of age -77, 31-40 years of age - 63, 41-50 years of age-67, 51-60 years of age-38, 61-70 years of age-14), brown colour denotes the D3 type(21-30 years of age-28, 31-40 years of age - 18, 41-50 years of age-17, 51-60 years of age-13, 61-70 years of age-5) and purple colour denotes the D4 type(21-30 years of age -1, 41-50 years of age-2).Chi square test was done and the association between gender and type of bone density was found to be statistically significant.(Chi square test-8.75, p=0.02, p<0.05). It was seen that among the age group of 41-50 years, D2 (n=67) was the most common type of bone density and D4 (n=2) was the least common type.

INFERENTIAL STATISTICS :

Figure 4 shows association between site of implant placed and bone density. No statistical significance (p>0.05).

Posterior maxilla - Most common - D2 ; Least common - D3.

Anterior maxilla- D2 - most common ; Least common -D4

Posterior Mandible - D2 - most common ; D4 - least common .

Anterior Mandible- D2 - most common; D3-Least common .

Figure 5 shows association between bone and gender density.Statistically significant (p <0.05)

D2 was the most common type of bone density noticed among both males and females. D4 type of bone density was not noticed among the female population included in the study.

Figure 6 shows association between age and bone density. Statistical significance was observed(p<0.05)

As age increases , density of bone also decreases . D1- density- most common - 21-30 years of age .

IV. DISCUSSION:

As the results obtained from the study, it is seen that implants are most commonly placed among the younger age group. (21-30 years of age). This is contradictory to a study by Dudley et al [8], which reports implants can be of much significance in the elder age group as in cases of full mouth rehabilitation, implant supported complete dentures etc.

Males have reported the highest implant received population and a study done by Chrcanovic et al , reports that highest failures of implant is also in males[21]. Similarly, according to Haas et al ,[22] reports implants inserted in men are 1-21 times more likely to fail in men than women. This may be due to poor oral hygiene maintenance , habits, any systemic diseases etc.

According to[23,24] , suggest that bone density is increased in mandible than in maxilla which has been associated with lower volume and density of bone. This study is also in accordance with this study . A study done by Salimov et al;Turkyilmaz et al,[25,26] says that bone density in the implant recipient site has a prevailing influence on primary implant stability. Primary stability is a very important determinant of success rate. In this study we found that D2 is the most common type of bone density, it means that the implant possesses a very high chance of survival. Nevertheless, future studies have to be done to evaluate the long term success rate of the implants. Gender and bone density for dental implants is still continuing to be a debatable topic[27].

The overall consensus of this study agrees that females have low mineral density as age proceeds. They don't affect the implant survival rate on a long term basis. All the points taken into consideration and put to conclusion that bone density is an important parameter in the assessment of implant success. Gender, age, and other demographic factors are also a contributing factor which determines the overall treatment outcome[28].

Implant success is as difficult to describe as the success criteria required for a tooth. A range from health to disease exists in both conditions.The primary criteria for assessing implant,is it's bone quality or quantity . The presence of either one greatly compromises the implant and removal usually is indicated. Routine probing depths are not suggested in the absence of other signs or symptoms and may be related to the presence of local disease or preexisting tissue thickness before the implant was inserted. Bone loss is most often evaluated with radiographs, which only monitor the mesial and distal marginal bone next to the implant[29].

Implant failure is easier to describe than implant success or survival and may consist of a variety of factors[30,31]. Any pain, vertical mobility, and uncontrolled progressive bone loss warrant implant removal. The ICOI Pisa Consensus Conference has simplified and updated a Health Scale specific for endosteal implants and included categories of success, survival, and failure. In addition,these categories of health may be related to the prognosis of the existing conditions[32]. It is necessary that bone density should be considered as a key factor for implant success rate.

V. CONCLUSION:

Within the limits of the current study ist is seen that bone density is increased in the younger age and there is a statistically significant association between gender and bone density.

AUTHOR'S CONTRIBUTION:

Hemashree J contributed in the conception, acquisition of data, analysis, interpretation of data and also in drafting the article and revising it critically for important intellectual content.

Dr. Revathi Duraisamy contributed in the study design, supervision and final approval of the submitted version of the manuscript.

Dr. Manjari Chaudhary contributed in supervision and formatting , and other alignment corrections.

CONFLICT OF INTEREST :

The authors declare that there is no conflict of interest

REFERENCES:

1.   Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. Scand J Plast Reconstr Surg. 1969;3(2):81–100.

2.   Brånemark PI, Adell R, Albrektsson T, Lekholm U, Lundkvist S, Rockler B. Osseointegrated titanium fixtures in the treatment of edentulousness. Biomaterials. 1983 Jan;4(1):25–8.

3.   Jayesh RS, Dhinakarsamy V. Osseointegration. J Pharm Bioallied Sci. 2015 Apr;7(Suppl 1):S226–9.

4.   Emami E, Heydecke G, Rompré PH, de Grandmont P, Feine JS. Impact of implant support for mandibular dentures on satisfaction, oral and general health-related quality of life: a meta-analysis of randomized-controlled trials. Clin Oral Implants Res. 2009 Jun;20(6):533–44.

5.   Eckert SE, Wollan PC. Retrospective review of 1170 endosseous implants placed in partially edentulous jaws. J Prosthet Dent. 1998 Apr;79(4):415–21.

6.   Lekholm U, Gunne J, Henry P, Higuchi K, Lindén U, Bergström C, et al. Survival of the Brånemark implant in partially edentulous jaws: a 10-year prospective multicenter study. Int J Oral Maxillofac Implants. 1999 Sep;14(5):639–45.

7.   Giro G, Chambrone L, Goldstein A, Rodrigues JA, Zenóbio E, Feres M, et al. Impact of osteoporosis in dental implants: A systematic review. World J Orthop. 2015 Mar 18;6(2):311–5.

8.   Dudley J. Implants for the ageing population. Aust Dent J. 2015 Mar;60 Suppl 1:28–43.

9.   Jyothi S, Robin PK, Ganapathy D, Anandiselvaraj. Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture. Research Journal of Pharmacy and Technology. 2017 Dec 30;10(12):4339–42.

10. Ganapathy D, Sathyamoorthy A, Ranganathan H, Murthykumar K. Effect of Resin Bonded Luting Agents Influencing Marginal Discrepancy in All Ceramic Complete Veneer Crowns. J Clin Diagn Res. 2016 Dec;10(12):ZC67–70.

11. Ranganathan H, Ganapathy DM, Jain AR. Cervical and Incisal Marginal Discrepancy in Ceramic Laminate Veneering Materials: A SEM Analysis. Contemp Clin Dent. 2017 Apr;8(2):272–8.

12. Venugopalan S, Ariga P, Aggarwal P, Viswanath A. Magnetically retained silicone facial prosthesis. Niger J Clin Pract. 2014 Mar;17(2):260–4.

13. Ashok V, Nallaswamy D, Benazir Begum S, Nesappan T. Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report. J Indian Prosthodont Soc. 2014 Dec;14(Suppl 1):279–82.

14. Kannan A, Venugopalan S. A Systematic Review on the Effect of Use of Impregnated Retraction Cords on Gingiva. Research Journal of Pharmacy and Technology. 2018 May 30;11(5):2121–6.

15. Subasree S, Murthykumar K, Dhanraj. Effect of Aloe Vera in Oral Health-A Review. J Adv Pharm Technol Res. 2016;9(5):609.

16. Vijayalakshmi B, Ganapathy D. Medical management of cellulitis. Research Journal of Pharmacy and Technology. 2016;9(11):2067–70.

17. Jain AR, Nallaswamy D, Ariga P, Ganapathy DM. Determination of correlation of width of maxillary anterior teeth using extraoral and intraoral factors in indian population: A systematic review. World Journal of Dentistry. 2018 Jan 1;9(1):68–75.

18. Selvan SR, Ganapathy D. Efficacy of Fifth Generation Cephalosporins against Methicillin-Resistant Staphylococcus aureus- A Review. Research Journal of Pharmacy and Technology. 2016 Oct 28;9(10):1815–8.

19. Ashok V, Suvitha S. Awareness of all Ceramic Restoration in Rural Population. Research Journal of Pharmacy and Technology. 2016 Oct 28;9(10):1691–3.

20. Basha FYS, Ganapathy D, Venugopalan S. Oral Hygiene Status among Pregnant Women. Research Journal of Pharmacy and Technology. 2018 Jul 31;11(7):3099–102.

21. Chrcanovic BR, Albrektsson T, Wennerberg A. Dental implants inserted in male versus female patients: a systematic review and meta-analysis. J Oral Rehabil. 2015 Sep;42(9):709–22.

22. Haas R, Mensdorff-Pouilly N, Mailath G, Watzek G. Survival of 1,920 IMZ implants followed for up to 100 months. Int J Oral Maxillofac Implants. 1996 Sep;11(5):581–8.

23. Drage NA, Palmer RM, Blake G, Wilson R, Crane F, Fogelman I. A comparison of bone mineral density in the spine, hip and jaws of edentulous subjects. Clin Oral Implants Res. 2007 Aug;18(4):496–500.

24. Turkyilmaz I, Tözüm TF, Tumer C. Bone density assessments of oral implant sites using computerized tomography. J Oral Rehabil. 2007 Apr;34(4):267–72.

25. Salimov F, Tatli U, Kürkçü M, Akoğlan M, Oztunç H, Kurtoğlu C. Evaluation of relationship between preoperative bone density values derived from cone beam computed tomography and implant stability parameters: a clinical study. Clin Oral Implants Res. 2014 Sep;25(9):1016–21.

26. Turkyilmaz I, McGlumphy EA. Influence of bone density on implant stability parameters and implant success: a retrospective clinical study. BMC Oral Health. 2008 Nov 24;8:32.

27. Venkatakrishnan CJ, Bhuminathan S, Chandran CR, Poovannan S. Dental Implants in Patients With Osteoporosis – A Review. Biomedical and Pharmacology Journal. 2017 Sep 25;10(3):1415–8.

28. Famili P, Zavoral JM. Low Skeletal Bone Mineral Density Does Not Affect Dental Implants. J Oral Implantol. 2015 Oct;41(5):550–3.

29. Mohajerani H, Roozbayani R, Taherian S, Tabrizi R. The Risk Factors in Early Failure of Dental Implants: a Retrospective Study. J Dent. 2017 Dec;18(4):298–303.

30. Kannan A, Others. Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis. WORLD. 2017;8(6):496–502.

31. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, Navarasampatti Sivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.

32. Farhat Yaasmeen Sadique Basha, Rajeshkumar S, Lakshmi T, Anti-inflammatory activity of Myristica fragrans extract . Int. J. Res. Pharm. Sci., 2019 ;10(4), 3118-3120 DOI: https://doi.org/10.26452/ijrps.v10i4.1607

33. Ajay R, Suma K, Ali SA, Kumar Sivakumar JS, Rakshagan V, Devaki V, et al. Effect of Surface Modifications on the Retention of Cement-retained Implant Crowns under Fatigue Loads: An In vitro Study. J Pharm Bioallied Sci. 2017 Nov;9(Suppl 1):S154–60.